Recognition of subtle and universal facial expressions in a community-based sample of adults classified with intellectual disability

Title: Recognition of Subtle and Universal Facial Expressions in a Community Based Sample of Adults Classified with Intellectual Disability

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Abstract

Background

Across the USA and UK schemes now exist to aid the successful integration of adults with mild to moderate intellectual disabilities into general society. One factor that may prove important to the success of such schemes is social competence. Here, understanding the facial expressions of others is critical, as emotion recognition is a prerequisite to empathetic responding and an essential factor in social functioning. Yet research in this area is lacking, especially in community-based samples.

Method

We investigated the performance of 13 adults with mild to moderate intellectual disability (ID), relative to 13 age-matched controls, on three tasks of emotion recognition (emotion categorisation; recognition of valence; recognition of arousal), using a number of 'basic' (angry, happy) and more 'subtle' (compassionate, critical) emotional expressions, as well as the posers face in a default relaxed (i.e. 'neutral') state. Importantly, the sample was drawn from a community-based initiative, and was therefore representative of populations' government schemes target.

Results

Across emotion recognition tasks the ID adults, as compared to controls, were significantly impaired when labelling the emotions displayed by the poser as well as recognising the associated 'feelings' conveyed by these faces. This was especially true for the neutral, compassionate and angry facial expressions. For example, ID adults demonstrated deficits in categorising neutral and subtle emotional expressions, as well as assessing the valence of such facial expressions. In addition, ID adults also struggled to assess arousal levels; especially those associated with compassionate and angry faces.

Conclusion

Given both basic and subtle emotions are conveyed in a range of daily situations, errors in interpreting such facial expressions and, relatedly, understanding what potential behaviours such expressions signify could contributing to the social difficulties ID adults face. This is important since current initiatives such as ‘personalisation’ do not appear to have schemes supporting training in this area and understanding the facial expressions of others is, after all, one of our most important non-verbal social communication tools.

Words: 322

Introduction

In recent years there has been a shift in the policy of many Governments to increase the integration of adults with mild to moderate intellectual disabilities into society. For example, in the UK, one objective of 'Personalisation' policy (Department on Health, 2007; 2009; 2012) is to allow adults with a mild to moderate Intellectual Disability (ID) more control over their life, via increasing independence and participation in the community[1]. To meet this aim, adults classified with a mild ID who receive social care support are allocated a personal budget to obtain one-to-one support. The objective of this support is to enable mild ID adults to develop social and life skills to increase confidence and live independently. Similar funding mechanisms to personalisation are in place in the US with 32 States now providing some form of individual orientated support (see http://www.ncld.org/, 2014).

Via one-to-one support schemes individuals with mild ID receive training in a number of key areas to increase their integration into local communities. In the UK such schemes include 'drop-in' centres to increase life skills (e.g. Business in the community - www.bitc.org.uk), support via the internet (e.g. Netbuddy.org) and increasing engagement in sporting activities (e.g. specialolympics.org). However, one basic but essential skill that is often neglected is the processing of emotion and, particularly, understanding the facial expressions of others. Yet the ability to recognise the emotions and facial expressions of others is a fundamental component of social functioning (Simon et al. 1996), contributing to an individual's quality of life, as well as their ability to participate in communities (Nota et al. 2007) and respond empathetically (Blair, 2003; 2005).

[1] In the UK Department of Health Documentation the term 'learning disability' is used as the policy documents cover services for both adults and children. Across such documentation, however, the focus ***is*** on adult services.

One reason for the lack of training in this vital skill with ID adults is, perhaps, that little empirical research has been conducted into facial expression recognition with adults with learning/intellectual disabilities as compared to non-ID adults. For example, in January 2015, whilst a PsycINFO search of the terms 'adult learning disability' and 'emotion recognition' identified 430 and 2,262 articles, respectively, published in the last 10 years, when the two terms were combined only 3 publications were returned. Of these, two were conducted with offenders (Protor & Beail, 2007; Ralfs & Beail, 2007) and the third was a systematic review pertaining to aggression in ID adults (Larkin et al. 2013). In addition, combining the words 'adult intellectual disability' and 'emotion recognition' returned just one new article (Garcia-Villamisar et al. 2010); and this concerned emotion recognition as a comparison between ID adults and ID adults with co-morbid autistic spectrum. This shows a considerable paucity of research in this area. Consistent with this, one of the most current studies on adults with learning disabilities and emotion recognition, as compared to non-ID controls, is that of Owen et al. (2001; but see also Rojhan, Raybold & Schneider, 1995).

Owen et al. (2001) investigated whether emotion recognition deficits observed in mild to moderate ID adults reflected problems with categorising specific facial expressions or, more generally, problems with recognising the dimensions of emotion. That is, the valence and/or arousal value associated with particular emotions as suggested by Russell (1980). Put simply, valence reflects whether a facial expression is 'positive' or 'negative', and arousal reflects the extent to which a facial expression elicits some form of physiological (or cognitive) change; e.g. whether it is 'highly' arousing. Both dimensions are linked to social approach and avoidance type behaviours (Carver, 2001), which can be thought of as desire to engage with, or withdraw from, others respectively. Whilst a number of different facets of emotion were investigated, the main result returned was that ID adults were significantly impaired upon emotional facial expression categorisation. Of the six basic emotions tested

(anger, sadness, happiness, fear, disgust, surprise), ID adults were found to be significantly impaired across all expressions. Furthermore, ID participants performed more poorly as compared to non-ID adults when recognising the level of arousal (i.e., high vs. low) depicted in the facial photographs. In reviewing the results of Owen et al. (2001) it is important to note that not only was their sample size limited (ID participants = 6; Age-matched controls = 6) but, also, they excluded analysis of neutral faces from their categorisation of emotion. Given that neutral faces are often rated as negative (e.g. Lee et al. 2008), but represent the posers facial muscles in a relaxed state (e.g. Young et al. 1997), a so called 'neutral' face represents the default 'relaxed' facial expression of most individuals. Therefore, it is important to investigate the ability of ID adults' to recognise this facial expression as compared to non-ID adults, as an inability to read neutral faces could present a number of social challenges. Indeed, whilst previous research by Woodcock & Rose (2007) has revealed that ID adults with high levels of anger are less accurate at recognising neutral emotions than ID adults with low levels of anger, to aid the integration of ID adults into society a community based comparison between ID and non-ID adults is needed.

Building upon this, it has further been argued by Schultheiss & Hale (2007) that broad-smiling 'happy' emotional faces can actually be aversive, and processed as threatening by some individuals. This is because broad smiles can communicate social dominance. Considering this, it is likely that in daily communications more subtle blends of emotion are utilised. For example, whilst basic emotions (e.g. anger, disgust, happiness) have evolved to address more urgent threats and opportunities related to survival/reproduction (Plutchik, 1980; Tooby & Cosmides, 1990), more blended emotions (e.g. compassion) are likely to have evolved to deal with both threats and opportunities related to social interactions. Namely, these more subtle emotions likely aid in regulating social behaviour, cooperation and affiliation, and maintaining supportive and helpful social relationships on a daily basis

(Keltner 1996; Leary et al. 2007). To date, whilst these more subtle (or higher level) social emotions are underrepresented in emotion research studies *per se* (see Adolphs, 2002), they are especially underrepresented in research into emotion processing with ID adults. Yet the recognition of such emotions may be critical in allowing for successful integration of ID adults into society and specific communities.

Thus, the purpose of the present research was to further investigate processes of emotional recognition in ID adults as compared to non-ID adults by utilising facial expressions more readily observed in typical day to day situations as well as those classed as 'universal/basic'. Comparable to the research of Owen et al. (2001) we investigated processes of emotion recognition across three activities: facial categorisation, recognition of valence and recognition of arousal. The facial stimuli utilised within these activities were angry, neutral & happy faces from the NIMSTIM facial stimulus set (Tottenham et al. 2009) as well as compassionate, critical and neutral faces from the McEwan facial stimulus set (McEwan et al. 2014). This latter stimulus set has been developed to represent more naturally occurring facial expressions in daily life, with the 'compassionate' face defined as a blend of 'kindness, compassion and friendliness' (and comparable to 'empathy'), and the critical face a blend of 'criticism, contempt and disdainfulness'.

Methods

Participants

All participants (13 Non-ID, 13 ID) were recruited from the same organisation, a community based charity in the East Midlands (UK) that provides developmental support for adults with intellectual disabilities. The organisation provides an activity centre where the

focus is on socialisation and learning, and maintaining life skills. The study was approved by the local ethics committee and all participants gave fully informed consent.

The ID participants were adults with mild to moderate intellectual disabilities with an age ranging from 21-69 (Mean = 41.77, SD = 15.56, 8 female). To define adults as mild or moderately intellectually disabled, ICD-10 classification was adopted (Chapter 5, F70-F79). Adults with severe or profound learning disabilities were excluded from the study (also Chapter 5, F70-F79), as were participants with autism (ICD-10, Chapter 5, F84). The Non-ID participants formed the control group. These were aged-matched staff/volunteers within the same organisation (age range 22-69; Mean = 41.31, SD = 15.51, 11 female) and included University graduates (5) and support workers (3) amongst others. Thus our two samples were comparable, albeit larger in size, than the samples identified in Owen et al. (2001).

Materials

Facial Images

12 photographic images were used. Six were from the McEwan Set (McEwan et al. 2014) comprising two compassionate (6A-W0937, 28A-W1966), two neutral (6C-N0940, 28C-N1965) and two critical (6B-C0942, 28B-C1975) images, and six were from the NimStim Set (Tottenham et al. 2009) comprising: two happy (18F_HA_C, 36M_HA_C), two neutral (18F_NE_C, 36M_NE_C) and two angry (18F_AN_C, 36M_AN_C) images. The models were chosen with respect to sex (one female, one male per set) and the highest, most consistent, average scores across emotion expressions. Images from the McEwan facial set served as the 'subtle emotion' set whilst images from the NimStim Set served as the 'obvious emotion' set. Images were printed as grey scaled laminated portrait images (9cm X 12cm) with a black border.

Task Cue Cards

Emotion cue cards were used in all activities. For ease of comprehension, we used the higher-frequency words 'cross' and 'friendly' for the 'critical' and 'compassionate' faces. For the face categorisation task (activity one), the words 'happy', 'friendly, 'not feeling anything', 'cross', 'angry' and 'something else' were presented on individually laminated sheets. In activity two and three, cue cards were adapted from the valance and arousal diagrammatic rating scale of the self-assessment model (Ibanez, 2011). In the test of valence (activity 2), words used were 'feeling very bad', 'feeling bad', 'not feeling anything', 'feeling good', and 'feeling very good'. In the test of arousal (activity 3), words used were: 'feeling very calm', 'feeling calm', 'not feeling anything', 'feeling excited' and 'feeling very excited'. Both cue cards (sheets) were laminated.

Procedure

All participants were tested individually whilst at the organisation, in a quiet area separate from others. For ID participants an InPrint2 (symbols programme) written source was used to support explanations and ensure consent was fully informed. For ID participants a specialist stop sign system was also put into place to ensure an easy and accessible way for breaks, or to withdraw from the study.

All participants then took part in the three different tasks counterbalanced across participants. In addition and where possible we adopted the same task/scoring procedures as Owen et al. (2001).

Activity 1: Categorisation of faces

The experimenter started by saying *"This is activity one. I am going to show you 12 different pictures, one at a time. I would like you to tell me if you think the pictures show the person feeling 'happy', 'angry', 'friendly', 'cross', 'not feeling anything' or 'something else'. Here is an example."*. An example picture was then shown – this was a happy female from

the NimStim set which was not one of the 12 used in the actual task. The experimenter went on to explain *"Each picture will show a person feeling something different"*. At this point the emotion category cue cards were introduced and the example was matched with the correct cue card i.e. *"This picture shows a person feeling happy"*. The participant was then told *"Some of the pictures will be easier to match up to a word, if you can't tell what word it should be than say 'I don't know'"*. When the participant was ready to start, the 12 facial images were shown one at a time and the participant's response was recorded.

Activity 2: Recognition of valence

Here instructions and procedure were the same with the exception of task specifics; e.g. *"...I would like you to tell me where the pictures belong on a scale. Does the picture show a person 'feeling very good', 'feeling good', 'not feeling anything', 'feeling bad' or 'feeling very bad'. Here is an example."; …"This picture would fit best on the side of the scale nearest feeling very good".*

Activity 3: Recognition of arousal

Again instructions and procedure were the same with the exception of task specifics; 'e.g. ' *...Does the picture show a person 'feeling very emotional', 'feeling emotional', 'not feeling anything', 'feeling calm' or 'feeling very calm'..."; "...This picture would fit best on this side of the scale nearer to feeling excited."*.

Note that across the three tasks order of card presentation was randomised.

Scoring Procedure

Activity 1: Categorisation of faces

1a: Emotional Faces

A score of 2 was given for each correct emotion categorisation recognised for each facial emotion (e.g. happy, angry, friendly, cross) and a score of 1 was given if the emotion categorisation was the correct direction of 'joy' or 'anger' but the incorrect intensity of subtle

or obvious (see McEwan et al. 2014; Tottenham et al. 2009). As an example an angry facial emotion was scored 2 if identified as 'angry' and 1 if identified as 'cross' (with 0 used for 'happy', 'friendly', 'not feeling anything' or 'something else'), whereas a critical (i.e. cross) facial emotion was scored 2 if identified as 'cross' and 1 if identified as 'angry'. Thus for each stimulus set the score could range from 0 to 8.

1b. Neutral Faces

For the neutral faces a score of 2 was given for the categorisation 'not feeling anything' and a score of 1 for 'something else'. Thus for each stimulus set the score ranged from 0 to 4.

Activity 2: Recognition of faces: valence

2a. Emotional Faces

A score of 2 was given for each correct emotion dimension of valence recognised for each facial emotion and a score of 1 was given if the correct 'side' of the dimension was recognised but the intensity was incorrect (see Fontaine et al. 2007; McEwan et al. 2014; Tottenham et al. 2009). For example, a happy facial emotion scored 2 if rated 'feeling very good' and 1 if rated 'feeling good' (with 0 for 'not feeling anything', 'feeling bad' or 'feeling very bad'), whereas a compassionate facial emotion scored 2 if rated 'feeling good' and 1 if rated 'feeling very good'. Thus for each stimulus set the score could range from 0 to 8.

2b. Neutral Faces

For the neutral faces a score of 2 was given for the categorisation 'not feeling anything'. Thus for each stimulus set score ranged from 0 to 4.

Activity 3: Recognition of faces: arousal

3a. Emotional Faces

A score of 2 was given for each correct emotion dimension of arousal recognised for each facial emotion and a score of 1 was given when the correct 'side' of the dimension was recognised but the intensity was incorrect (see Fontaine et al. 2007; McEwan et al. 2014; Tottenham et al. 2009). That is, a happy facial emotion was scored 2 if rated 'feeling very emotional' and 1 if rated 'feeling emotional' (with 0 for 'not feeling anything', 'feeling calm' or 'feeling very calm'). A compassionate facial emotion, however, scored 2 if rated 'feeling emotional' and 1 if rated 'feeling calm'. An angry facial emotion scored 2 if rated 'feeling very emotional' and 1 if rated 'feeling emotional', similarly a critical (cross) facial emotion scored 2 if rated 'feeling emotional' and 1 if rated 'feeling very emotional'. Thus for each stimulus set (obvious, subtle) the score could range from 0 to 8.

3b. Neutral Faces

For the neutral faces a score of 2 was given for the categorisation 'not feeling anything'. Thus for each stimulus set the score ranged from 0 to 4.

Results

Activity 1: Categorisation of faces

Mean score for correct categorical recognition as a function of facial expression set (subtle, obvious) and disability (ID, non-ID) is presented in Table 1.

1a: Emotional Faces

Data was analysed using a 2 (facial expression set) x 2 (disability) mixed measures ANOVA. There was a significant main effect of stimulus set ($F(1, 24) = 78.99$, $p < .001$, $\eta_p^2 = 0.77$), but neither a main effect of disability ($p > 0.10$) nor a stimulus set by disability interaction ($p > 0.30$). For the main effect of stimulus set, across all individuals, correct categorisation of facial expression was greater for the obvious facial expression set (i.e. angry, happy) as compared to the subtle facial expression set (i.e. compassionate, critical).

*****Table 1 about here*****

1b: Neutral Faces

As analyses revealed no differences in performance as a consequence of stimulus set (i.e. obvious vs. subtle), data across stimulus sets was combined. An independent t-test revealed that ID adults performed significantly worse than Non-ID adults when categorising the neutral (i.e. *'not feeling anything'*) facial expressions $t(24) = -6.056$, $p < 0.001$. Further exploration revealed that this categorisation error reflected ID adults not being able to consistently categorise neutral faces, with a bias for ID adults, as compared to non-ID adults, to report such faces as 'happy', $\chi^2 = 12.12$, DF =1, $p < 0.001$ (see Figure 1).

*****Figure 1 about here*****

Activity 2: Recognition of faces: valence

Mean score for recognition of the emotional valence of a face as a function of facial expression set and disability is presented in Table 2.

2a: Emotional Faces

A mixed measures ANOVA revealed a significant main effect of stimulus set ($F(1, 24) = 12.87$, $p < .01$, $\eta_p^2 = 0.35$), a significant main effect of disability ($F(1, 24) = 30.66$, $p < .001$, $\eta_p^2 = 0.56$) and a significant stimulus set by disability interaction ($F(1, 24) = 6.57$, $p < .05$, $\eta_p^2 = 0.22$). To clarify the interaction, an independent t-test of mean score, with disability as the independent variable, was undertaken separately for each stimulus set. These analyses revealed that ID adults performed significantly worse across both stimulus sets, but that this performance decrement was greater for the subtle $t(24) = -5.220$, $p < 0.001$, as compared to the obvious facial stimulus set $t(24) = -2.13$, $p < .05$.

*****Table 2 about here*****

To explore this valence decrement, a two (ID, Non-ID) by four (cross, angry, happy, friendly) mixed measures ANOVA was undertaken as a function of *specific* emotional expression. This analysis revealed a main effect of emotional expression ($F(3, 72) = 8.18$, $p < 0.01$, $\eta_p^2 = 0.25$), a main effect of disability ($F(1, 24) = 30.66$, $p < 0.001$, $\eta_p^2 = 0.56$) and a significant emotional expression by disability interaction ($F(3, 72) = 2.87$, $p = .042$, $\eta_p^2 = 0.11$). Consequently, bonferroni corrected independent t-test's of mean score, with disability as the independent variable, were undertaken separately for each facial expression type. This revealed that ID adults performed significantly worse when rating the emotional valence of cross/critical ($t = -3.023$, $df = 24$, $p < 0.01$) and compassionate/friendly faces ($t = -7.016$, $df = 24$, $p < 0.001$) and marginally worse when rating the emotional valence of angry faces ($t = -2.42$, $df = 24$, $p = 0.023$). Further exploration revealed that these errors reflected a bias for ID adults compared with non-ID adults to rate compassionate faces as *'very good'*, critical faces as *'not feeling anything'* and angry faces as *'bad'* (see Table 3).

*****Table 3 about here*****

2b: Neutral Faces

As analyses revealed no differences in performance as a consequence of stimulus set, data across sets was combined. An independent t-test revealed that ID adults performing significantly worse than Non-ID adults when rating the valence of neutral facial expressions i.e. '*not feeling anything*' $t(24) = -4.066$, $p < 0.001$. Further exploration revealed that this error reflected ID adults struggling to rate the valence of these faces consistently (see Figure 2).

*****Figure 2 about here*****

Mean score for recognition of the emotional arousal of a face as a function of facial expression set and disability is presented in Table 4.

Activity 3: Recognition of faces: arousal

3a: Emotional Faces

A mixed measures ANOVA revealed a significant main effect of disability only ($F(1, 24) = 31.07$, $p < .001$, $\eta_p^2 = 0.56$). These analyses revealed that ID adults performed significantly worse across both stimulus sets when rating faces according to the dimension of arousal.

*****Table 4 about here*****

To explore this arousal decrement further a two (ID, Non-ID) by four (cross, angry, happy, friendly) mixed measures ANOVA was undertaken as a function of emotional expression. This analysis revealed a main effect of emotional expression ($F(3, 72) = 2.84$, $p = .044$, $\eta_p^2 = 0.11$), a main effect of disability ($F(1, 24) = 31.07$, $p < 0.001$, $\eta_p^2 = 0.56$) and a near significant emotional expression set by disability interaction. ($F(3, 72) = 2.64$, $p = .056$, $\eta_p^2 = 0.10$). Consequently, an independent t-test of mean score, with learning disability as the independent variable, was undertaken separately for each facial expression type. This revealed that ID adults performed significant worse when categorising the emotional arousal of the angry ($t=-5.167$, $df = 24$, $p < 0.001$) and compassionate/friendly faces ($t=-4.577$, $df = 24$, $p < 0.001$). Further analyses revealed that these errors reflected inconsistencies across ID adults when rating arousal for angry faces, and a tendency for ID adults to rate compassionate faces as calm (see table 5).

*****Table 5 about here*****

3b: Neutral Faces

As analyses revealed no differences in performance as a consequence of stimulus set, data across sets was combined. An independent t-test revealed no effect disability ($p > 0.80$).

Discussion

Building upon the work of Owen et al. (2001), the present research investigated processes of emotional recognition in a community-based sample of ID adults as compared to non-ID adults by utilising facial expressions more readily observed in typical daily situations as well as those classed as 'universal'. Across all three different task domains (i.e. emotion categorisation; recognition of valence; recognition of arousal) results were significant. Firstly, concerning facial categorisation, whilst performance across all adults was poorer when categorising faces from the subtle emotion (as compared to the universal emotion) set, ID adults were significantly less proficient when categorising 'neutral' facial expressions. Secondly, when considering emotional valence, whilst ID adults (in comparison to non-ID adults) were significantly less proficient at assessing valence across stimulus sets, this was especially marked for the compassionate, critical and neutral expressions. Finally, when considering emotional arousal, ID adults were significantly less proficient at assessing arousal across stimulus sets; this was especially marked for the compassionate and angry faces. These findings will be discussed in turn.

That all participants found it more difficult to correctly *categorise* the critical and compassionate faces as compared to the angry and happy faces is novel, but expected. Indeed, it is important to note that by their very nature the subtle stimuli may be harder to define and label than the basic emotional stimuli, as they constitute higher-order emotions (i.e. composites of Ekman & Friesen's (1976) basic six emotions). This would further explain why all participants also found it more difficult to correctly assess the dimension of valence for the subtle as compared to the basic stimuli (i.e. Task 2). However, of more importance, was the novel finding that across stimulus sets ID adults demonstrated a significant deficit when categorising 'neutral' faces (Task 1b). Further inspection of this data revealed that ID adults struggled to consistently label these faces as 'not feeling anything' when compared

with non-ID adults. Rather, as a group, ID adults demonstrated a significant bias, as compared to non-ID adults, to report such faces as 'happy'. This finding is important given a 'neutral' face represents the posers facial muscles in a relaxed state (Young et al. 1997) and, previously, such facial expressions have been suggested to be ambiguous (Meyer et al. 2004). Certainly, in non-ID adults there is a tendency to identify neutral faces as slightly negative (e.g. Lee et al. 2008; see also Cooney et al. 2006), which is in contrast to what we found with our ID participants (and the research of Woodcock & Rose, 2007). It is significant that our ID adults tended to categorise a 'neutral' face as 'happy', as a 'neutral' face indicates neither approach nor avoidance type social behaviours. Therefore, one could hypothesise that the safest social behavioural response may be to 'avoid' interactions with individuals displaying this facial pose, as reflected by the slightly negative appraisal of this face type in previous research. Thus, that our ID adults tended to show the opposite bias could potentially lead to inappropriate social behaviours, i.e. a bias to approach (or engage), rather than avoid such individuals.

It was further found that across stimulus sets ID adults, as compared to non-ID adults, struggled to correctly identify the *valence* of the different facial stimuli and, in particular, that associated with the compassionate (friendly), critical (cross) and neutral facial expressions. For the compassionate faces these errors reflected categorisation errors at the level of 'intensity' (e.g. rating a compassionate face as 'very good' rather than 'good'); and the same appeared true for the angry faces (i.e. ratings of 'bad' rather than 'very bad'). This suggests that ID adults have some ability to discriminate between certain pleasant and unpleasant emotions at a superordinate level. For the critical and neutral faces, however, errors were more complex. For example, for the critical faces, errors reflected a large minority of ID adults (36%) rating this face 'as not feeling anything', whereas for the neutral faces, ID adults struggled to consistently rate the valence of such faces (with errors reflecting the broad

spectrum of intensity levels from ‘feeling very good’ to ‘feeling very bad’). Taken together, and contrary to the research of Owen et al. (2001), such results suggest that ID adults are impaired in their ability to discriminate between certain pleasant and unpleasant emotions, especially when more subtle or ambiguous emotions are considered. Importantly, given that such subtle expressions are suggested to be commonly used in daily situations (e.g. McEwan et al. 2014), deficits in correctly discriminating whether a current emotion displayed is positive or negative could again pose problems for ID adults in social situations. That is, correctly identifying the valence of an emotion is an important social cue with regard to determining one’s own social behaviour; i.e. as stated above, whether one should approach or avoid/withdraw from the poser of this emotional expression.

Finally, we also found our ID adults, as compared with non-ID adults, to be significantly poorer at recognising the intensity of *arousal* associated with the emotional stimuli. In particular, ID adults struggled to correctly identify the arousal intensity associated with the compassionate and angry faces. Here, ID adults were more likely to label the compassionate faces as ‘feeling calm’ (as opposed to ‘feeling emotional’) and struggled to consistently identify the arousal intensity of the angry faces. Emotion recognition is an important prerequisite for empathetic responding (Blair, 2003; 2005). Thus that the majority of our ID participants failed to recognise the compassionate faces as being emotional, could have implications for ID adults to understand the social message being conveyed by such ‘subtle’ facial expressions and the reciprocal (or otherwise) action appropriate. This, again, would limit the ability of an ID adult to identify an appropriate response e.g. approach or avoidance. Related to this, that a large minority of our ID participants (5/13) failed to identify the angry faces as ‘very emotional’ or even ‘emotional’ (suggesting instead that these facial expressions reflected the poser ‘not feeling anything’, ‘feeling calm’ or ‘feeling very

calm'), demonstrates that ID adults can also struggle to identify social messages conveyed by not so subtle (i.e. universal) facial expressions.

To sum, our results demonstrate a community based ID adult sample to be impaired across a number of core emotion recognition tasks, with these impairments affecting both subtle and more basic facial expressions, as well as the face in a default relaxed (i.e. neutral) pose. Whilst caution should be exercised when moving from experimental studies employing static photographic stimuli to real-life social settings, our study has relevance/importance given the increasing emphasis on integrating ID adults into the community through schemes such as 'personalisation'. Indeed, whilst a significant limitation of our research is the lack of stringent controls when assigning participants to conditions (i.e. we did not collect current WAIS-IV scores across all participants), it is such non-specific ID populations (or 'learning disabled' adults if UK government policy wording is used) to whom personalisation schemes are aimed. Thus, our findings suggest that to improve the success of such 'non-specific' schemes, it may be beneficial for community based samples of ID adults to receive support in understanding and recognising different facial emotions (see also Wood & Kroese, 2007). Here, one area of further exploration may be facial mimicry, as emerging research with autistic populations demonstrates that mimicry training improves both key facial expression recognition and the identification of the emotions/feelings they convey (e.g. Gordon et al. 2014; Harrold et al. 2014). Alternatively, at the very least, our findings indicate that more research is needed concerning this vital social skill - utilising comparisons with non-ID adults, more ecologically valid facial expressions and perhaps more stringent sampling as well as reaction time based tasks. In terms of the successful integration of ID adults into specific communities, not understanding the emotion an individual is displaying, nor being able to correctly assert if the emotion is positive or negative (or, even, what the poser may be feeling), could lead to maladaptive interactions and/or social isolation. This is consistent with

the hypothesis that among those with ID, emotion recognition deficits may be a contributory factor to the larger social difficulties such individuals observe (Stewart & Singh, 1995). Thus much more research is needed in this area.

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Table 1: Mean categorisation score as a function of stimulus set and population

Activity 1a	**Subtle**	**Obvious**
Intellectually Disabled	3.69 (1.25)	6.54 (1.33)
Non-Intellectually Disabled	4.54 (1.39)	6.85 (.81)
Activity 1b	**Neutral (Subtle)**	**Neutral (Obvious)**
Intellectually Disabled	.77 (1.01)	.85 (.99)
Non-Intellectually Disabled	2.46 (1.20)	3.31 (1.11)

Table 2: Mean emotional valence score as a function of stimulus set and population

Activity 2a	**Subtle**	**Obvious**
Intellectually Disabled	4.08 (1.61)	6.38 (1.33)
Non-Intellectually Disabled	7.00 (1.22)	7.38 (1.04
Activity 2b	**Neutral (Subtle)**	**Neutral (Obvious)**
Intellectually Disabled	0.46 (0.88)	1.08 (1.55)
Non-Intellectually Disabled	2.46 (1.66)	2.62 (1.50)

Table 3: Valence rating score as a function of emotional facial expression and population

	Face	Valence Rating				
		Very Good	Good	NFA	Bad	Very Bad
Intellectually Disabled	Happy	20	4	1		1
Non-Intellectually Disabled		24	2			
Intellectually Disabled	Friendly***	19	6			1
Non-Intellectually Disabled		2	24			
Intellectually Disabled	Critical**	4	2	8	10	2
Non-Intellectually Disabled				5	20	1
Intellectually Disabled	Angry*	1		1	9	15
Non-Intellectually Disabled					4	22

Table 4: Mean emotional arousal score as a function of stimulus set and population

	Subtle	Obvious
Intellectually Disabled	3.00 (1.35)	3.62 (1.33)
Non-Intellectually Disabled	5.69 (1.55)	6.08 (1.55)
	Neutral (Subtle)	**Neutral (Obvious)**
Intellectually Disabled	1.54 (1.45)	1.08 (1.32)
Non-Intellectually Disabled	0.92 (1.04)	1.54 (1.45)

Table 5: Arousal rating score as a function of emotional facial expression and population

	Face	Arousal Rating				
		Very Emotional	Emotional	NFA	Calm	Very Calm
Intellectually Disabled	**Happy**	9	5	1	9	2
Non-Intellectually Disabled		8	13	1		4
Intellectually Disabled	**Friendly*** **	5	4	2	10	5
Non-Intellectually Disabled			18		6	2
Intellectually Disabled	**Critical**	1	6	4	2	3
Non-Intellectually Disabled		2	15	5	4	
Intellectually Disabled	**Angry*** **	8	8	4	4	2
Non-Intellectually Disabled		24	2			

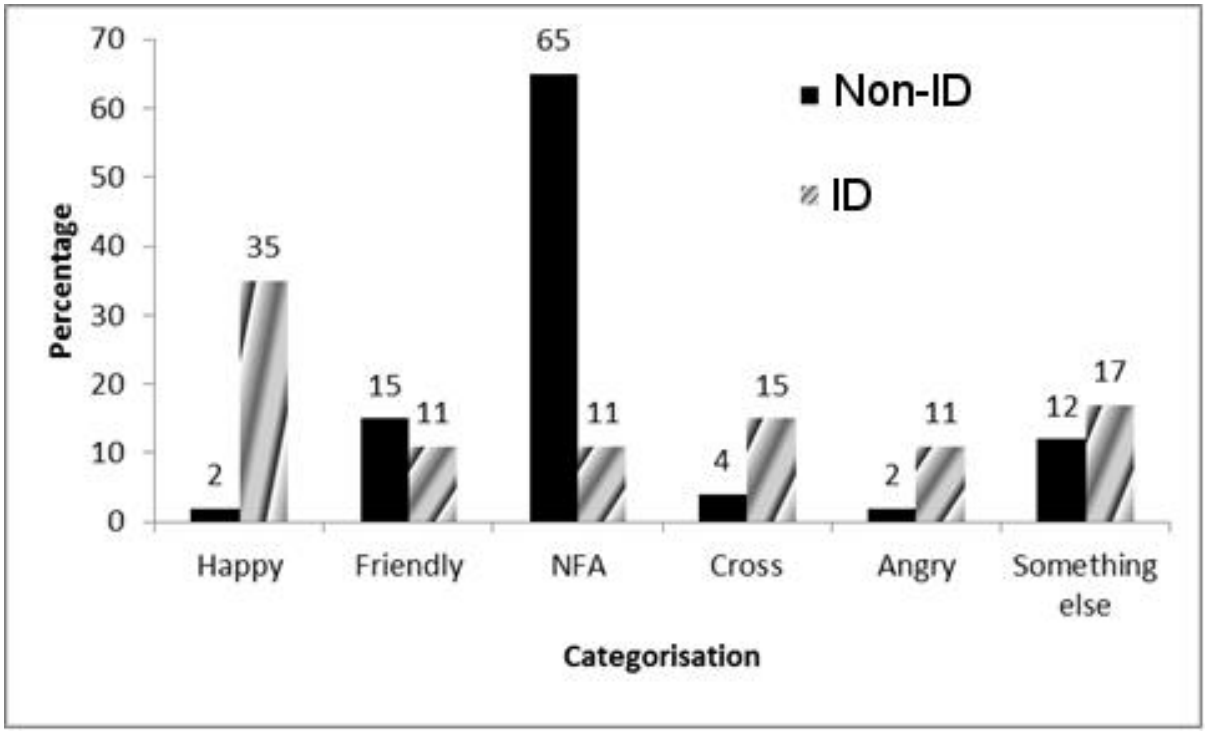

Figure 1: Neutral facial expression categorisation as a function of population

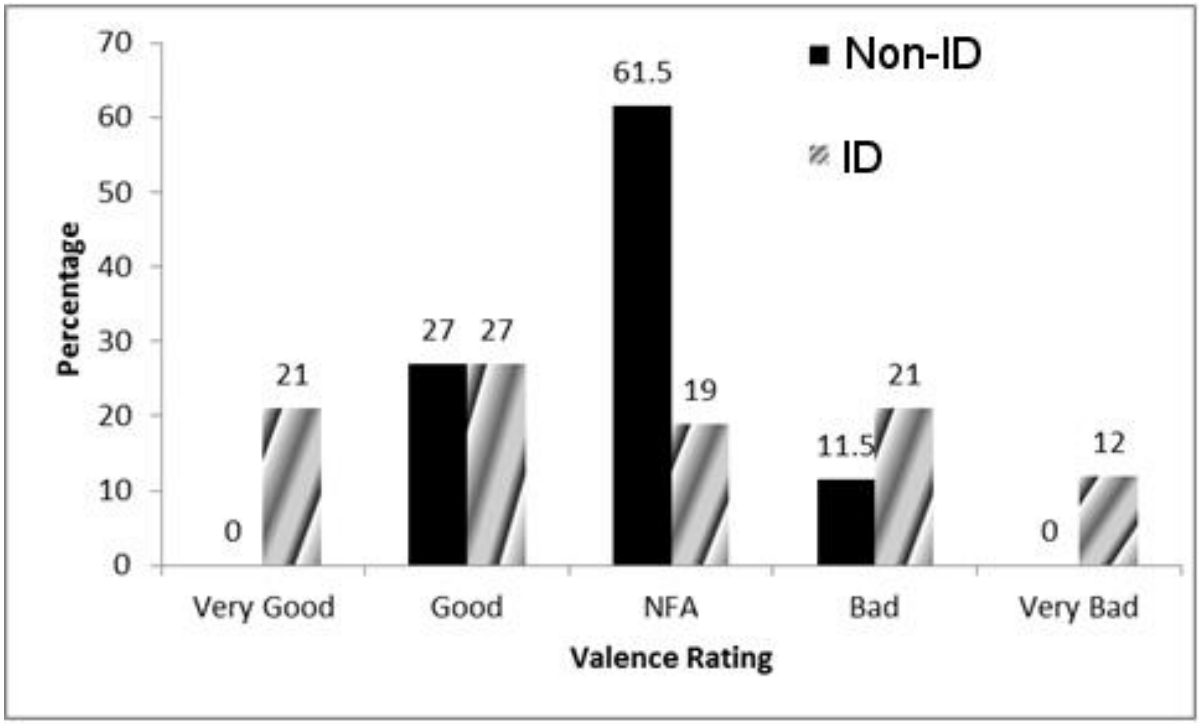

Figure 2: Neutral facial valence rating as a function of population